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ABSTRACT

This learning module has two main goals: (1) to increase students' knowledge and understanding of the often complex relationship between sustainable development and the social, economic, and environmental conditions in a country; and (2) to strengthen students' ability to perform statistical calculations, make and interpret maps, charts, and tables, as well as analyze and synthesize information to make inferences and generalizations and to think critically when analyzing information, making decisions, and solving problems. This learning module focuses specifically on environmental issues, particularly access to safe water. The teaching units in the module contain a full range of questions, activities, and exercises. The module is divided into the following sections: (1) "Introduction" (Point of View, Goals and Objectives, Teaching the Learning Modules); (2) "Environment"; (3) "Safe Water Text"; (4) "Map: Safe Water"; (5) "Chart 1 - World Population and Access to Safe Water, 1989-95"; (6) "Chart 2 - Life Expectancy and Improvements in Water Supply and Sanitation in Three French Cities, 1820-1900"; (7) "Chart 3 - Sources of Water in Mozambique, 1996"; (8) "Environmental Data Tables"; (9) "Access to Safe Water Photo Gallery Water Treatment Plant, Colombia"; (10) "Access to Safe Water Photo Gallery Children Washing Hands, Guatemala"; (11) "Case Study 1: The Water Problem in My Village, Bolivia"; (12) "Safe Water Research and Explore"; and (13) "Glossary." (BT)

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ED 434 062

Development Education Program

"Bringing sustainable development into the classroom"

Environmental - Access To Safe Water Learning Module

SO 031 036

World Bank

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For Teachers

Point of View

The point of view of these learning modules is:

- Economic development is a means to a better life for people everywhere, especially those living in low- and middle-income countries.
- All countries, rich and poor, face environmental problems that are often closely linked with efforts to reduce poverty and improve people's standard of living.
- The relationship between economic development and the environment is complex, and reliable data are often scarce.
- Rising economic activity can both cause environmental problems and, with the right policies and institutions, help solve them.
- Greater economic strength and higher standards of living in all countries contribute to a healthy, vigorous world economy.
- The increased interdependence among countries that accompanies economic development can benefit all countries.
- This interdependence means that meeting the needs of people today without jeopardizing our ability to meet the needs of future generations is an issue that affects all people in all countries.

Goals and Objectives

The learning modules have two main goals:

- to increase students' knowledge and understanding of the often complex relationship between sustainable development and the social, economic, and environmental conditions in a country;
- to strengthen students' ability to perform statistical calculations, to make and interpret maps, charts, and tables,; to analyze and synthesize information to make inferences and generalizations; and to think critically when analyzing information, making decisions, and solving problems.

As a result of using these learning modules, students should be able to:

- recognize basic areas of social, economic, and environmental concern that affect people in all countries;

Environmental

This is a brief introduction to environmental issues of sustainable development. When you have finished reading here, you can start exploring the Access to Safe Water learning module.

Environmental Sector

The goal of sustainable development is to improve living standards and the quality of people's lives, both now and for future generations. Environmental issues are an important piece of the development "puzzle."

Environmental issues affect everyone

Industrial and developing countries alike share environmental concerns. Both must strive to ensure that citizens in both cities and rural areas have clean air to breathe, safe drinking water, and adequate supplies of clean renewable energy. Agriculture and industry must make efficient and responsible use of the natural resources--land, soil, forests, rivers, oceans, mineral deposits--upon which they rely.

Local issues/global issues

Some environmental issues are highly localized, but many others cross national borders. Industrial and human waste dumped into a river by one country may affect the health and livelihoods of citizens in another country hundreds of miles downstream. Ozone-depleting gases cause changes in the earth's atmosphere that may result in rising cancer rates and lower crop yields in countries around the world. As global interdependence increases, solving environmental problems requires greater cooperation and coordination between nations regionally and worldwide.

Linking the environment with the economic and social sectors.

Environmental concerns are inextricably linked to economic issues such as poverty. People living in poverty may damage the environment as they struggle simply to survive, cutting down trees for fuel wood, exhausting crop land, and contaminating urban water supplies with waste they cannot afford to treat.

Environmental concerns are also linked with social issues such as population growth. A rapidly growing population places strains on a country's natural resources, as well as on its ability to provide housing, health care, education, safe water, and sanitation for all.

It is only when information about the environment is combined with social and economic data that citizens and decision makers can understand the full impact of development decisions on the quality of life. The challenge for governments is to create development strategies that incorporate values of environmental sustainability, while increasing economic growth and providing

- compare and contrast social, economic, and environmental conditions in developing and industrial countries;
- demonstrate an understanding of the relationships between population growth rate, GNP per capita, and access to clean water;
- make inferences from statistics about living conditions, levels of economic development, and issues of sustainable development;
- express opinions about sustainable development and use statistics to support them.

Teaching the Learning Modules

This Teaching Guide has teaching units to accompany each learning module. These teaching units contain a full range of questions, activities, and exercises. You can get answers by clicking on the Answers icon.

Begin teaching each indicator by discussing the definition of the indicator, then continue with the map, text, charts and graphs, data table, case studies, and photos.

Activities included here are not organized by increasing complexity.

The blank comparative data table is designed so that, in most cases, space is available for students to add more data if you wish to have them do so.

adequate social services.

Environmental indicators

One way of measuring a country's level of development is to look at environmental data such as access to safe water, which measures the percentage people who can get all the safe water they need to lead healthy lives. As you explore the Access to Safe Water learning module, what other types of environmental data and information would help you better understand how people live in a particular country? What kinds of economic and social data would give you a fuller picture of what life is like in that country?

Safe Water Text

Did You Know?

The adult human body is about 50 to 65 percent water. A child's body is approximately 75 percent water. The human brain is about 75 percent water.
While the human body can live for weeks without food, it can only survive a few days without water.
220 million urban residents in the developing world lack a source of safe drinking water near their homes.
Ninety percent of urban sewage in the developing world is discharged into rivers, lakes, and coastal water ways without any treatment.
Agriculture consumes 60 to 80 percent of the fresh water resources in most countries, and as much as 90 percent in others.

- More than one billion people lack access to safe water. Close to two billion people lack access to sanitation. Most of these people live in low- and middle-income countries.
- Each year, nearly a billion people suffer from diarrheal illnesses caused by unsafe water. Millions more suffer from other water-related diseases. Poor people, especially the very young and the elderly, tend to be the most at risk.
- Safe water is scarce because it is often undervalued and used inefficiently.
- As a country's economy becomes stronger—as its GNP per capita rises—a larger percentage of its people tend to have access to safe water and sanitation.
- Thoughtful decisionmaking by all user groups generally leads to improvements in the supply of safe water for all people at affordable prices.

Access to Safe Water

Access to safe water is measured by the number of people who have a reasonable means of getting an adequate amount of water that is safe for drinking, washing, and essential household activities, expressed as a percentage of the total population. It reflects the health of a country's people and the country's capacity to collect, clean, and distribute water to consumers.

Water is essential for life, yet in 1995, more than one billion people in low- and middle-income countries—and an additional50 million people in high-income countries—lacked access to safe water for drinking, personal hygiene and domestic use.

These numbers, as Chart 1 shows, represented nearly 25 percent of the world's 5.7 billion people. In addition, close to 2 billion people did not have access to adequate sanitation facilities.

What is "safe" water and why is it important?

Safe water includes treated surface water, as well as untreated but uncontaminated water from sources such as natural springs and sanitary wells. On average, a person needs about 20 liters of safe water each day to meet his or her metabolic, hygienic, and domestic needs. Without safe water, people cannot lead healthy, productive lives. For example, an estimated 900 million people suffer—and approximately 2 million die—from water-related diarrheal illnesses each year. Most, but not all, of these people live in low- and middle-income countries, and those at greatest risk are children and the elderly. Millions more people worldwide suffer from other water-related diseases, such as bilharzia, cholera, elephantiasis, and hookworm.

Improvements in water supply and sanitation tend to lead to improvements in people's health and the quality of their lives. Chart 2 shows the results of improvements in water and sanitation service upon the life expectancy of people in three French cities during the19th century. Throughout history, when people have had an adequate supply of safe water and have been able to practice good hygiene, they have been healthier and have had a better chance of living longer.

Access to safe water is critical to economies and ecosystems, too, and a scarcity of safe water can directly affect long-term prospects for sustainable development. Without an adequate water supply, factories that depend on water may have to close temporarily; crop yields may decline; sick workers may be unproductive; fisheries may be destroyed. The destruction of aquatic life not only cuts into the economy, but also damages the ecosystem. In addition, lack of a reliable system of piped water can prompt people to sink their own wells and deplete the fresh water supply. Air quality can also be affected by shortages of safe water. When people boil household water to kill dangerous bacteria, the fuel they burn can pollute the air. And when they use wood or charcoal as their source of fuel, forests can be destroyed causing additional environmental problems, including erosion and loss of top soil.

Safe water is becoming scarce

Aside from the fact that some regions of the world are naturally arid, the increasing, often competing demands for water are cutting into the global supply. Many rivers and watersheds are polluted by industrial, agricultural, and human waste products, while others are drying up because people are using the water faster than nature can replenish it. In areas with heavy rainfall or irrigation systems, people may waste water because it seems plentiful or cheap, ignoring how much it costs to treat the water after it is used.

Getting water is more difficult—and often more expensive—for the poorest people. In rural areas of developing countries, many women and children spend hours—in extreme cases up to six to eight hours—each day hauling water from rivers or wells. In cities, the poor often do not have water piped to their property; instead, they must buy or take water from other sources. Chart 3 illustrates an example of where people living in an urban metropolitan area in a developing country get their water, showing that only about a third of the population has water piped to either their home or yard. People buying water from other sources may have to pay three to ten

times what piped water costs in an area.

Moreover, the rapid growth of cities throughout the world can strain the capacity of governments to provide adequate sanitary facilities, leaving inhabitants, especially the poor, to live amid unhealthy open sewage ditches. Untreated sewage also tends to contaminate the water reserves closest to the cities, forcing communities to pipe water from further and further away as cities expand.

Industrial countries also are increasingly concerned about water quality and availability. Although these countries have stronger economies and greater capacity to collect, clean, and deliver water to citizens, per capita water consumption can be high as people wash cars, water lawns, and turn deserts into farmland, towns, and cities. They spend enormous amounts of money cleaning up water polluted by industrial waste, energy production, agriculture, and households.

The realities of supply and demand

Ensuring that people have an adequate supply of safe water involves an often complex mixture of social, economic, and environmental issues. In recent years, people, industries, farmers, and governments have begun to acknowledge that water is an economic good, not a "free" limitless resource. And as an economic good, there is a wide range in the quality and level of water delivery and sanitation services that people want and are willing to pay for.

Experience from around the globe shows that when people, even the poorest, have a choice in the quality of their water supply and sanitation services, they often are willing to pay a higher price to get higher quality. For example, people who are unwilling to pay for operating and maintaining low quality handpumps and pit latrines may be willing to pay more to get a basic system of piped water and sewers that works fairly and efficiently.

On the other hand, households and industries are not always willing to pay for higher quality services if they feel that what they are receiving is already good enough. For example,some coastal communities in the United States have refused to pay for what they perceive to be unnecessary and expensive sewage treatment even though it is required by federal law for environmental protection. In the end, it appears that when members of a community—households, factories, farmers, and businesses, together with scientists and policy makers—all participate in making decisions about the most feasible system of supplying safe water and sanitation, everyone tends to be more satisfied with the quality and price of these services.

Exploring the Access to Safe Water Text

1. Read the text and the definition of access to safe water and answer the following questions:

   a. What does this indicator measure? **[The number of people who have reasonable means of getting clean water, expressed as a percentage of a country's total population.]**

   b. How is "reasonable" access defined for people in urban areas? **[There should be a public fountain or water spigot within 200 meters of the household.]**

   c. How is "reasonable" access defined for people in rural areas? **[People should not have to spend a disproportionate amount of time fetching water each day.]**

   d. What would you consider a reasonable amount of time to spend each day getting water? **[Answers will vary.]**

   e. How do you and your family get water? **[Answers will vary]**

   2. When people drink contaminated water, they can become ill. Answer each of the following questions briefly, referring back to the text if necessary.

      a. How many people suffer each year from diarrheal diseases related to dirty water? **[Approximately 900 million.]**

      b. Which people or age group(s) are at greatest risk? **[Children or elderly people are at greatest risk.]** Why might this be the case? **[Possible answer: Children and the elderly tend not to be as strong as young and middle-age adults, and therefore cannot cope as well with the dehydration that accompanies diarrhea.]**

      c. If so many people become ill from contaminated water, why do they drink it? **[Possible answers: People may not realize that a water source is contaminated. The body requires water to survive, therefore people are forced to drink whatever water is available. Sometimes people do not know that they can make water safe by boiling it; even if they know how to make water safe, they might not be able to find or afford fuel to heat it. Other times, safe water can become contaminated by being stored in dirty containers.]**

   3. Using the text and your own experience, complete the following exercises.

      a. Make a list of some of the ways in which you and your community use

water. To the right of each item, write an "H" for household uses or a "C" for community use. Place an asterisk (*) next to the items that probably require safe water. **[Possible answers: Household: drinking*, bathing*, washing clothes and dishes*, cleaning, cooking. Community: watering crops and livestock*, waste disposal, source of power, solvent, ingredient in various products, coolant, source of recreation*.]**

b. Which of these uses are likely to pollute water? **[With the exception of drinking, all of them to varying extents.]**

4. Listed below are some household uses of water and estimates of how much water they use (based on an industrial country plumbing system). From these estimates, answer the questions that follow.

Flushing toilets	3–5 gallons of water per flush
Brushing teeth, washing dishes, etc.	3–5 gallons of water per minute for running tap
Showering	5–7 gallons of water per minute
Bathing	35–50 gallons of water per bath

a. Assuming that each member of your family had access to 20 liters (approximately 5 gallons) of safe water each day (the amount most often cited as being "adequate" when defining access to safe water), make a list of how you would use the water. **[Answers will vary.]**

b. How would you conserve the water? **[Answers will vary.]**

c. How could you re-use some of the water for other purposes? **[Answers will vary.]**

5. In Bangladesh, the poorest people spend 11 percent of their household income on fuel to boil their drinking water. In the urban slums of Nigeria, people spend 18 percent of the household income for water. In Port of Spain, the capital of Trinidad and Tobago, the poorest people spend 20 percent of their household income for water.

a. Find these three countries on the map. What regions do they belong to? **[Bangladesh, Asia (East and South) and the Pacific; Nigeria, Sub-Saharan Africa; Trinidad and Tobago, North and Central America and the Caribbean]**

b. How much would a family earning $40,000 a year spend for water in each of these countries? (Convert each percentage to a decimal by dividing it

by 100, and then multiply each decimal by $40,000.) **[$4,400 in Bangladesh; $7,200 in Nigeria; $8,000 in Trinidad and Tobago.]**

6. Answer each of the following questions briefly, referring back to the text if necessary.

   a. What are three major contaminants that contribute to the scarcity of safe water? **[human, agricultural, and industrial waste]**

   b. How can contamination from human waste be minimized? **[Through adequate sanitation facilities: basic drainage and sewerage systems.]**

   c. How might contamination from agricultural and industrial waste be minimized? **[Agriculture: use fertilizers and pesticides more carefully; use natural predators, such as other insects that prey on destructive bugs without damaging crops, instead of pesticides. Industrial: introduce cleaner methods of production that generate less pollution and waste; use safer methods of waste disposal]**

7. What does it mean to say that safe water is an "economic" good? **[There is a limited supply of safe water and there are various consumers who want it.]**

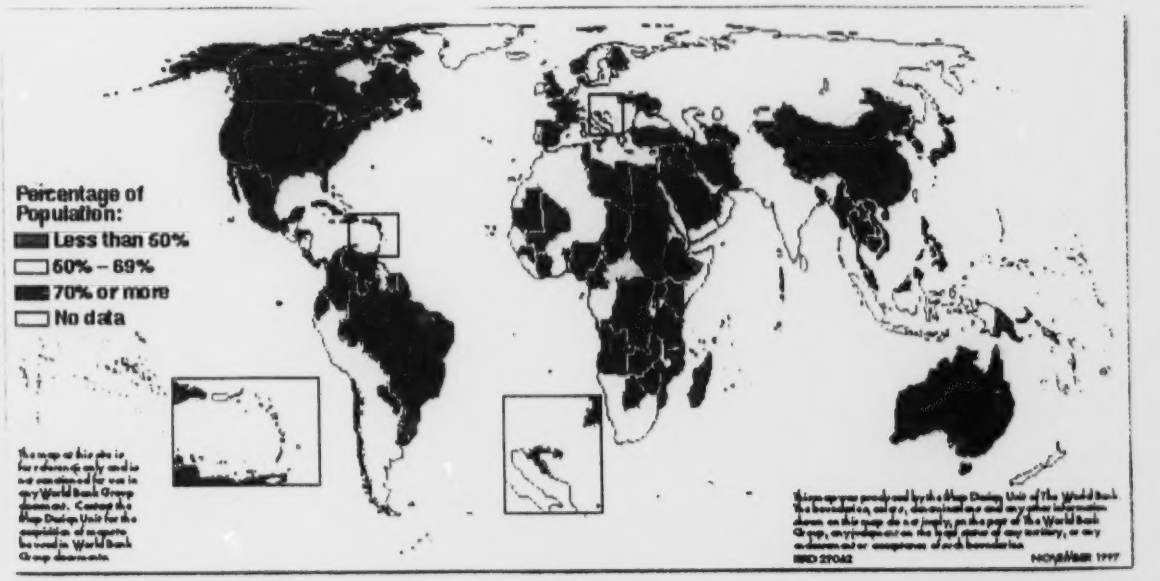
8. Why is it important for all of the consumers of water to be part of the decisionmaking processes concerning safe water and sanitation? **[If some people are left out of the decisionmaking, there is a chance that not everyone will get the services they want and are willing to pay for.]**

9. Use the text, charts, and Data Table to argue for or against this statement:

   The poorest people suffer the most from the lack of safe water.

10. Are there times when people in your community do not have enough water? When? Why? What do people do? Are there any government or community policies to help during these times? If so, what are they? **[Answers will vary.]**

Access to Safe Water, 1989-95



Access to safe water is measured by the number of people who have a reasonable means of getting clean water, expressed as a percentage of the total population. It reflects the health of a country's people and the country's ability to collect, clean, and distribute water. Countries in which few people have access to safe water tend to be located in Africa and Asia. Countries in which most people have access to safe water tend to be located in Europe, North America, and parts of Asia and South America.

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Exploring the Safe Water Map

1. Study the map and answer the following questions:

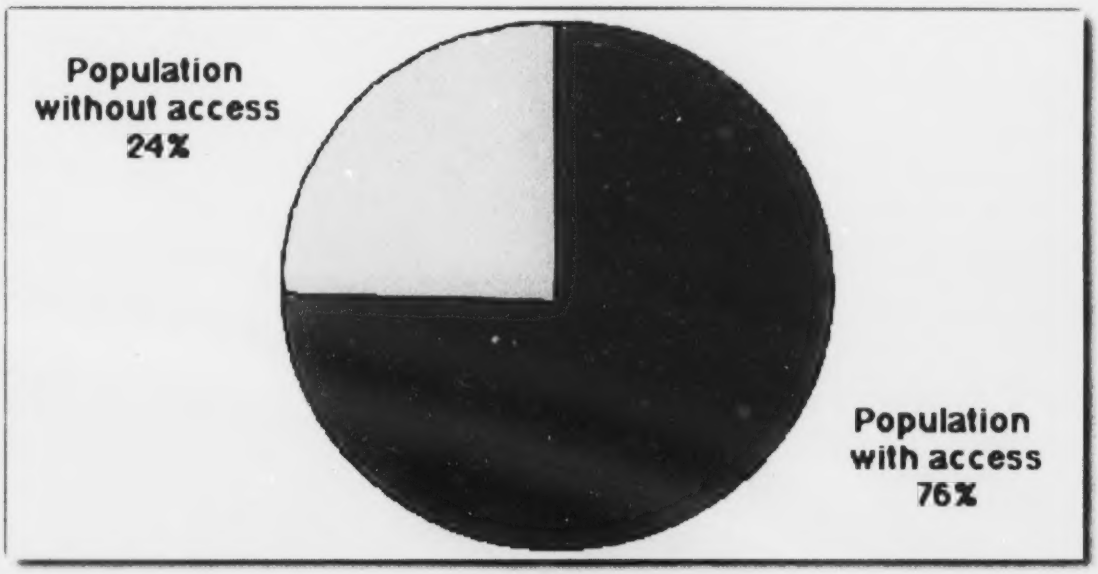
   a. According to the map key, which color represents the countries with the lowest percentage of people with access to safe water? **[orange]** Which color represents the highest? **[green]**

   b. Which region of the world has the lowest percentage of people with access to safe water? **[Sub-Saharan Africa]** The next lowest? **[Asia (South and East) and the Pacific]**

2. Find Brazil, China, Morocco, and Nigeria on the map. Compare the color of each country with those of its neighbors. To what extent is each country typical of conditions in its area and region? **[Brazil, China, and Nigeria are fairly typical of their regions; Morocco is less typical.]** Make a general statement comparing the six regions. **[Possible answer: People in Sub-Saharan Africa and in Asia (South and East) and the Pacific tend to have less access to safe water than people in other areas of the world.]**

3. What might social and economic conditions be like in the areas with the lowest percentage of access to safe water? **[Answers will vary. Possible answers: Many people are probably poor and often sick. It is likely that they also lack adequate sanitation facilities.]**

Chart 1. Percentage of the World's Population With and Without Access to Safe Water, 1989–95



In 1995, nearly 25 percent of the world's 5.7 billion people lacked access to safe water for drinking, personal hygiene, and domestic use.

Exploring Chart 1 - Percentage of the World's Population With and Without Access to Safe Water, 1989–95

1. Study Chart 1, which shows world population and access to safe water and answer the following questions.

   a. What percentage of the world's population in 1989–95 did not have access to safe water? **[24%]**

   b. The total population of the world in 1995 was approximately 5.7 billion. Using your answer to question 1a, calculate how many people were without safe water in the years 1989–95? (Divide the percentage by 100 to get a decimal, then multiply the total population of the world by the decimal figure). **[approximately 1.37 billion]**

   c. How many people did have access to safe water? **[5.7 billion – 1.37 billion = 4.33 billion]**

2. In the year 2010, the population of the world is projected to reach 6.8 billion.

   a. If the number of people with access to safe water stays the same as it was in 1989–95, what percentage of the world's population in 2010 will have access to safe water? (Divide 4.33 billion by 6.8 billion and multiply by 100.) **[64%]**

   b. How does this percentage compare with that shown in Chart 1? **[It is smaller.]** Based on this information, would the population in 2010 be better off, worse off, or the same? Explain. **[They would be worse off, because the percentage of the population with safe water would have decreased from 76% to 64%, and safe water is necessary for life.]**

3. Statistics can be powerful tools that help us understand our world. But statistics must be used carefully, and people must understand what the data do and do not tell us.

   It is the year 2000. You are running for reelection after two five-year terms as mayor of a city of 800,000 people. In 1990, the population was 600,000, and at that time 37 percent of the population in the city had access to safe water. In the year 2000, 40 percent of the population in the city now have access to safe water.

   a. Did the percentage of population with access to safe water and sanitation increase or decrease during your time as mayor? **[It increased.]** By how much? **[3%, from 37% to 40%]**

b. Calculate the number of people with access to safe water in 1990. **[600,000 x .37 = 222,000]** Calculate the number of people with access to safe water in 2000. **[800,000 x .40 = 320,000]** Did the number of people with access to safe water increase or decrease during your time as mayor. **[It increased.]** By how much? **[320,000 – 222,000 = 98,000 people]**

c. Did the number of people without access increase or decrease? (Find the percentage of the population without access by subtracting the percentage of the population with access from100%, convert the percentage into a decimal, and then follow the calculations you used in question 2b.) **[It increased.]** By how much? **[102,000 people: 800,000 x .60 = 480,000; 600,000 x .63 = 378,000; 480,000 – 378,000 = 102,000 people]**

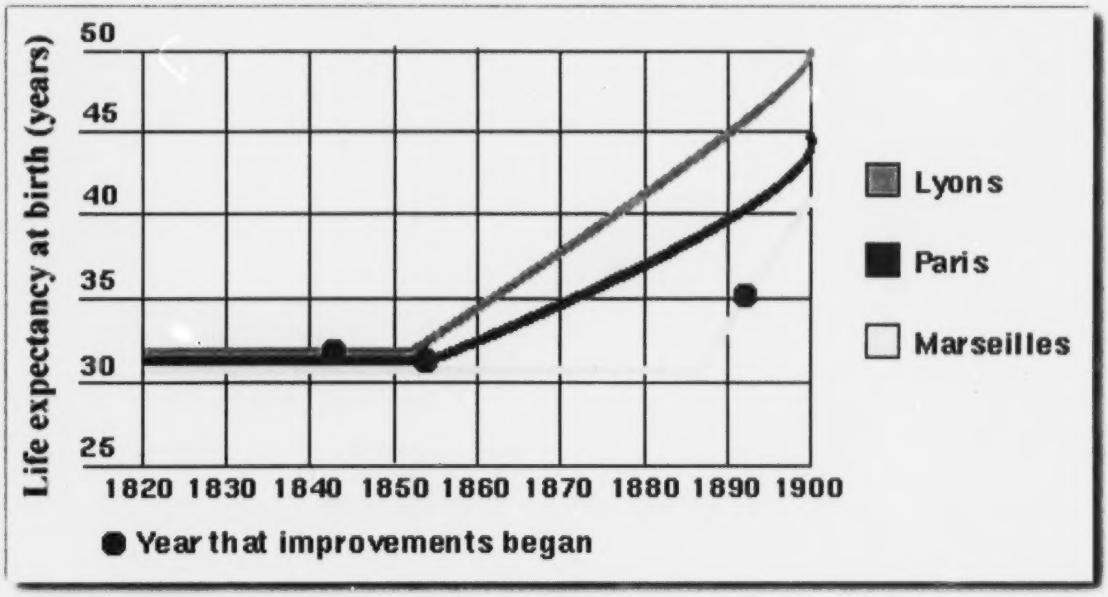
d. As mayor, what can you say to voters about the progress you have made in the area of safe water and sanitation? **[Possible answer: "Since I took office, 98,000 more people have access to safe water. The share of the population with access to safe water has increased from 37% to 40%."]**

e. What might your challenger say to voters about the lack of progress you have made? **[Possible answer: "The current mayor is not doing her job. Today, 102,000 more people lack access to safe water than in 1990. More people are suffering."]**

f. What can happen if statistics are not used carefully? **[They may be used to misrepresent or distort the facts.]**

g. What kinds of problems might make it difficult to provide safe water to people in urban areas where populations are growing rapidly? **[Possible answers: Too many people may need services too quickly; there may be a lack of money, materials, expertise, and skilled workers to lay pipe or repair leaks; local political leadership may not be able or willing to mobilize resources.]**

Chart 2. Life Expectancy and Improvements in Water Supply and Sanitation in Three French Cities, 1820-1900



Throughout history, when people have had an adequate supply of safe water and have been able to practice good hygiene, they have been healthier and have had a better chance of living longer.

Exploring Chart 2 - Life Expectancy and Improvements in Water Supply and Sanitation in Three French Cities, 1820-1900

1. Read the definition of life expectancy. From your own experience, list at least five factors that can affect life expectancy. **[Possible answers: illness, violence, natural disasters, poor nutrition, access to and quality of medical care, smoking, drinking, hazardous work.]**

2. Study Chart 2 which suggests a relationship between life expectancy and improvements in water supply and sanitation in three French cities from 1820–1900.

   a. What was the life expectancy in each city in 1820? **[Lyons, 32 years; Paris, 32 years; Marseilles, 32 years]** What was the life expectancy in each city in 1900? **[Lyons, 50 years; Paris, 45 years; Marseilles, 41 years]** What was the general trend for all three cities? **[Life expectancy increased over time.]**

   b. About what year did each city begin its water supply and sanitation improvements? **[Lyon,1844; Paris, 1854; Marseilles, 1892]**

   c. What does the chart suggest was the reason life expectancy was higher in Lyons in 1900 than in Paris or Marseilles? **[Lyons improved water supply and sanitation earlier.]**

   d. According to Chart 2, life expectancy in Marseilles began improving even before water and sanitation did. What are some possible explanations for this? **[Possible answers: medical advances, better nutrition, increased awareness of basic hygiene]**

3. In the social sciences, researchers usually use current data to explore conditions and issues. Why would water supply, sanitation, and life expectancy information from 19th century France be helpful for people learning about these issues today? **[Possible answers: In the 19th century, medicine was not as advanced as it is today, so it is easier to show a cause and effect relationship between improvements in one area and its direct effect on the population. Also, in the past, France and other industrial countries faced water and sanitation problems similar to those some developing countries face today, so perhaps countries today can learn from past successes and failures.]**

4. Use the text, Chart 2, and your own knowledge, to argue for or against this statement:

Access to safe water and sanitation are not luxuries that can wait for a stronger economy; rather, they are necessary in order to build a stronger economy.

5. You are a government official in a middle-income country. A crisis exists in your country because an epidemic of cholera has broken out and is spreading rapidly. You are holding an emergency meeting with other officials to decide what to do. As you plan your course of action, consider the following:

- Cholera is spread by fecal contamination of food and water.
- Victims become extremely thirsty and need lots of water or they will die from dehydration.
- Hospitals are overcrowded in your country even when there is no epidemic.
- Households can boil their drinking water for 10 minutes to make it safe. But most people are not aware of this, and, even if they were, it would cost the average poor family a third of its income to do so.
- Tourism has disappeared, and other countries will no longer buy fruits and vegetables grown in your country.

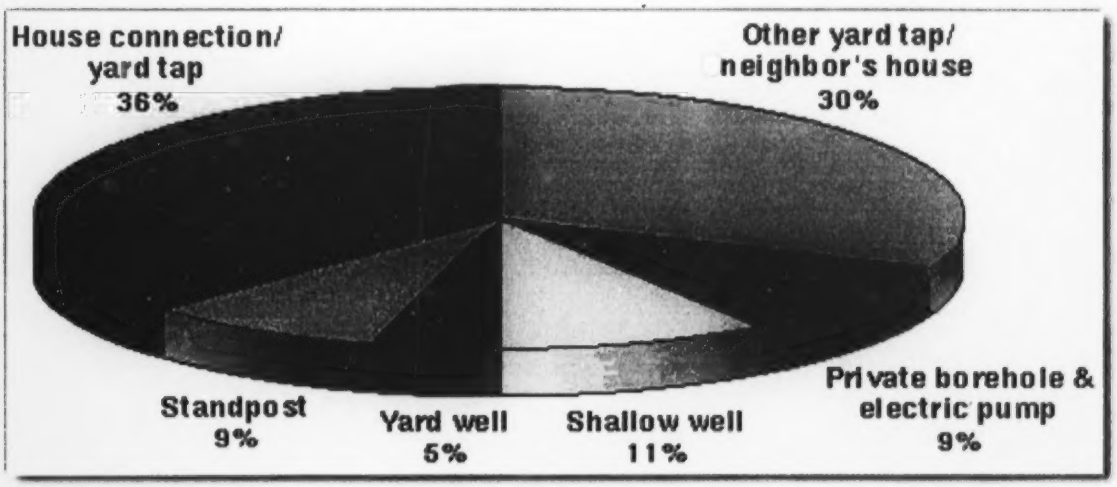
a. What actions would you take immediately? **[Answers will vary.]**

b. What policies would you set up for the long run? **[Answers will vary.]**

c. How would you pay for these measures? **[Answers will vary.]**

d. What world resources might be available to help your country through this disaster? **[Answers will vary.]**

Chart 3. Sources of Water in Maputo, Mozambique, 1996



Only about a third of the people in this urban metropolitan area have clean water piped to their homes or yards. The rest of the people must depend on other sources that may be expensive, unreliable, or far from their homes.

Exploring Chart 3 Sources of Water in Maputo, Mozambique, 1996

1. Which of the sources of water shown in Chart 3 bring water directly to a person's home or yard? **[house connection, yard tap, yard well]** What percentage of the people get their water from these sources? **[about 41%]** Which sources of water require people to leave their homes or yards to get water? **[standpost, shallow well, private borehole with electric pump, other yard tap or neighbor's house]** What total percentage of the people get their water from these sources? **[59%]**

2. Think about the sources of water listed above.

   a. What might be some drawbacks to having to leave your home or yard to get water for your everyday needs? **[Possible answers: Water is heavy and you will probably have to make several trips to get all the water you need. You may have to walk long distances and stand in line. There may not be enough water for everyone. The mechanism for getting the water may be broken.]**

   b. Bearing these difficulties in mind, who would you expect to use more water, people with sources of water in their home or yard, or people who have to fetch it from some place else? Explain. **[People with house connections would probably use more water because their water use is not limited by the amount they can carry or the time it takes to fetch it.]**

3. The table below shows the average consumption and cost of safe water for the people of Maputo. Use the information from the table to answer the questions below.

Drinking water Source	Average consumption of drinking water (cubic meters per month)	Average cost of drinking water (Mts.* per cubic meter)
House connection	17.6	1,341
Other sources	4	3,751

**Mts. is the abbreviation for Mozambique's currency, the metical.*

   a. Who uses more drinking water, people with house connections or others? **[people with house connections]** How many times more water do they use than others? **[more than four times.]**

b. Who pays less per unit for their water, people with house connections or others? **[people with house connections]**

c. Based on your answers to questions 3a and 3b, make a general statement describing the relationships among water cost, convenience, and consumption. **[Possible answer: For people with house connections, safe water is both convenient and inexpensive. When water is cheaper and easier to obtain, households tend to consume more.]**

d. If people without house connections are consuming water at a rate below the World Health Organization's recommended daily minimum of 20 liters per person, what changes might you expect to see if they were connected to the piped water system? **[Their safe water consumption would probably increase. People would probably become healthier and have higher life expectancy because they would be able to drink more safe water, practice better hygiene, and wash their fruits and vegetables and cook with safe water.]**

e. How do people in your community get their water? **[Answers will vary.]**

Environmental Data Tables	
Asia (South and East) and the Pacific	North and Central America and the Caribbean
Europe and Central Asia	South America
Middle East and North Africa	Sub-Saharan Africa

Asia (South and East) and the Pacific										
			1	2	3	4	5	6	7	8
			Total Population		Population Growth		GNP per Capita		Access to Safe Water	Access to Sanitation
			millions		average annual growth rate (%)		$	PPP*	% of population	% of population
			1995	2010	1980-95	1995-2010	1995	1995	1989-95	1989-95
L	1	Afghanistan	..	..	..	..	l	..	..	..
H	2	Australia	18	20	1.4	0.8	18,720	18,940	95	90
L	3	Bangladesh	120	150	2.2	1.5	240	1,380	83	30
L	4	Cambodia	10	14	2.9	2.0	270	..	13	..
L	5	China	1,200	1,347	1.3	0.8	620	2,920	46	..
H	6	Hong Kong,China	6	6	1,4	0,2	22,990	22,950a	..	..
L	7	India	929	1,127	2.0	1.3	340	1,400	63	29
M	8	Indonesia	193	235	1.8	1.3	980	3,800	63	55
H	9	Japan	125	128	0.5	0.1	39,640	22,110	95	85
M	10	Korea, Dem. Rep	24	29	1.8	1.3	M	..	100	100
H	11	Korea, Rep	45	50	1.1	0.8	9,700	11,450	89	100
L	12	Lao PDR	5	7	2.8	2.8	350	..	41	30
M	13	Malaysia	20	26	2.5	1.8	3,890	9,020	90	94
L	14	Mongolia	2	3	2.6	1.8	310	1,950	54	..
L	15	Myanmar	45	57	1.9	1.6	L	..	39	42
L	16	Nepal	21	30	2.5	2.2	200	1,170	48	22
H	17	New Zealand	4	4	1.0	0.8	14,340	16,360	..	..
L	18	Pakistan	130	190	3.0	2.5	460	2,230	60	30
M	19	Papua NewGuinea	4	6	2.2	2.0	1,160	2,420	31	26
M	20	Phillippines	69	90	2.3	1.8	1,050	2,850	84	75
H	21	Singapore	3	3	1.8	1.0	26,730	22,770	100	100
L	22	Sri Lanka	18	21	1.4	1.1	700	3,250	57	66
M	23	Thailand	58	65	1.5	0.7	2,740	7,540	81	87
L	24	Vietnam	73	93	2.1	1.6	240	..	38	21

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M middle income economy l estimated to be a low-income country m estimated to be middle incomecountry

Europe and Central Asia

			1	2	3	4	5	6	7	8
			Total Population		Population Growth		GNP per Capita		Access to Safe Water	Access to Sanitation
			millions		average annual growth rate (%)		$	PPP*	% of population	% of population
			1995	2010	1980-95	1995-2010	1995	1995	1989-95	1989-95
L	25	Albania	3	4	1.3	1.0	670	..	..	100
L	26	Armenia	4	4	1.3	0.8	730	2,260	..	..
H	27	Austria	8	8	0.4	0.1	26,890	21,250	..	100
L	28	Azerbaijan	8	9	1.3	1.0	480	1,460	..	..
M	29	Belarus	10	10	0.5	0.1	2,070	4,220	..	100
H	30	Belgium	10	10	0.2	0.1	24,710	21,660	..	100
L	31	Bosnia Herzegovina	..	..	..	..	L	..	..	..
M	32	Bulgaria	8	8	-0.3	-0.3	1,330	4,480	..	99
M	33	Croatia	5	5	0.3	0.0	3,250	..	96	68
M	34	Czech Republic	10	10	0/1	0.0	3,870	9,770	..	..
H	35	Denmark	5	5	0.1	0.1	29,890	21,230	100	100
M	36	Estonia	1	1	0.0	-0.5	2,860	4,220	..	..
H	37	Finland	5	5	0.4	0.2	20,580	17,760	100	100
H	38	France	58	60	0.5	0.3	24,990	21,030	100	96
L	39	Georgia	5	6	0.4	0.1	440	1,470	..	..
H	40	Germany	82	82	0.3	0.0	27,510	20,070	..	100
M	41	Greece	10	11	0.5	0.2	8,210	11,710	..	96
M	42	Hungary	10	10	-0.3	-0.2	4,120	6,410	..	94
H	43	Ireland	4	4	0.4	0.7	14,710	15,680	..	100
H	44	Italy	57	56	0.1	-0.1	19,020	19,870	..	100
M	45	Kazakhstan	17	18	0.7	0.7	1,330	3,010	..	..
L	46	Kyrgyz Republic	5	5	1.5	1.1	700	1,800	75	53
M	47	Latvia	3	2	-0.1	-0.7	2,270	3,370	..	..
M	48	Lithuania	4	4	0.6	-0.1	1,900	4,120	..	..
M	49	Macedonia, FYR	2	2	0.8	0.8	860	..	..	..

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M	50	Moldova	4	5	0.5	0.3	920	..	..	50
H	51	Netherlands	15	16	0.6	0.3	24,000	19,950	100	100
H	52	Norway	4	5	0.4	0.3	31,250	21,940	100	100
M	53	Poland	39	40	0.5	0.3	2,790	5,400	..	100
H	54	Portugal	10	10	0.1	0.1	9,740	12,670	..	100
M	55	Romania	23	22	0.1	-0.1	1,480	4,360	..	49
M	56	RussianFederation	148	145	0.4	-0.1	2,240	4,480	..	..
M	57	Slovak Republic	5	6	0.5	0.2	2,950	3,610	..	51
M	58	Slovenia	2	2	0.3	0.0	8,200	..	..	90
H	59	Spain	39	39	0.3	0.0	13,580	14,520	99	97
H	60	Sweden	9	9	0.4	0.2	23,750	18,540	..	100
H	61	Switzerland	7	7	0.7	0.2	40,630	25,860	100	100
L	62	Tajikistan	6	8	2.6	1.9	340	920	..	62
M	63	Turkey	61	75	2.1	1.4	2,780	5,580	92	94
M	64	Turkmenistan	5	6	3.0	2.3	920	..	85	60
M	65	Ukraine	52	50	0.2	-0.2	1,630	2,400	97	49
H	66	United Kingdom	59	60	0.3	0.2	18,700	19,260	100	96
M	67	Uzbekistan	23	31	2.4	2.0	970	2,370	..	18
M	68	Yugoslavia, FR	11	11	0.7	0.2	m	..	..	100

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H High-income economy
L Low-income economy
M middle income economy
l estimated to be a low-income country
m estimated to be middle income country
a. References to GNP relate to GDP

Middle East and North Africa										
			1	2	3	4	5	6	7	8
			Total Population		Population Growth		GNP per Capita		Access to Safe Water	Access to Sanitation
			millions		average annual growth rate (%)		$	PPP*	% of population	% of population
			1995	2010	1980-95	1995-2010	1995	1995	1989-95	1989-95
M	69	Algeria	28	36	2.7	1.7	1,600	5,300	..	..
M	70	Egypt, Arab Rep.	58	73	2.3	1.6	790	3,820	84	..
M	71	Iran, Islamic Rep.	64	91	3.3	2.4	M	5,470	89	82
M	72	Iraq	20	31	2.9	3.0	M	..	45	36
H	73	Israel	6	7	2.4	1.4	15,920	16,490	99	70
M	74	Jordan	4	6	4.4	2.4	1,510	4,060	89	30
H	75	Kuwait	2	2	1.3	2.6	17,390	23,790	..	..
M	76	Lebanon	4	5	2.3	1.3	2,660	..	..	..
M	77	Libya	5	9	3.8	3.2	m	..	30	18
M	78	Morocco	27	34	2.1	1.6	1,110	3,340	59	63
M	79	Oman	2	4	4.6	3.8	4,820	8,140	56	72
M	80	Saudi Arabia	19	31	4.7	3.3	7,040	..	93	86
M	81	Syrian Arab Rep.	14	21	3.2	2.7	1,120	5.320	87	78
M	82	Tunisia	9	11	2.3	1.5	1,820	5,000	86	72
H	83	United Arab Emir	2	3	5.7	2.2	17,400	16,470	98	95
M	84	West Bank & Gaza	2	4	3.9	4.1	m	..	..	..
L	85	Yemen, Rep	15	25	3.9	3.3	260	..	52	51

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North and Central America and the Caribbean										
			1	2	3	4	5	6	7	8
			Total Population		Population Growth		GNP per Capita		Access to Safe Water	Access to Sanitation
			millions		average annual growth rate (%)		$	PPP*	% of population	% of population
			1995	2010	1980-95	1995-2010	1995	1995	1989-95	1989-95
H	86	Canada	30	32	1.2	0.6	19,380	21,130	100	85
M	87	Costa Rica	3	4	2.7	1.5	2,610	5,850	100	99
M	88	Cuba	11	12	0.8	0.6	m	..	94	66
M	89	Dominican Rep.	8	9	2.1	1.3	1,460	3,870	79	85
M	90	El Salavador	6	8	1.4	2.0	1,610	2,610	62	73
M	91	Guatemala	11	15	2.9	2,5	1,340	3,340	64	71
L	92	Haiti	7	9	1.9	1.3	250	910	28	24
L	93	Honduras	6	9	3.2	2.5	600	1,900	70	68
M	94	Jamaica	3	3	1.1	1.0	1,510	3,540	70	74
M	95	Mexico	92	114	2.1	1.5	3,320	6,400	87	70
L	96	Nicaragua	4	6	3.0	2.4	380	2,000	57	..
M	97	Panama	3	3	2.0	1.3	2,750	5.,980	82	87
M	98	Puerto Rico	4	4	1.0	0.8	m	..	..	..
M	99	Trinidad& Tobago	1	1	1.2	1.0	3,770	8,610	82	56
H	100	United States	263	297	1.0	0.8	26.980	26,980	90	85

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South America										
			1	2	3	4	5	6	7	8
			Total Population		Population Growth		GNP per Capita		Access to Safe Water	Access to Sanitation
			millions		average annual growth rate (%)		$	PPP*	% of population	% of population
			1995	2010	1980-95	1995-2010	1995	1995	1989-95	1989-95
M	101	Argentina	35	40	1.4	1.0	8,030	8,310	64	89
M	102	Boliva	7	10	2.2	2.1	800	2,540	60	44
M	103	Brazil	159	190	1.8	1.2	3,640	5,400	92	73
M	104	Chile	14	17	1,6	1.1	4,160	9,520	96	71
M	105	Columbia	37	45	1.8	1.3	1.910	6,130	96	70
M	106	Ecuador	11	15	2.4	1.7	1,390	4,220	70	64
M	107	Paraguay	5	7	2.9	2.1	1,690	3,650	8	30
M	108	Peru	24	30	2.1	1.6	2,310	3,770	60	47
M	109	Uruguay	3	3	0.6	0.6	5,170	6,630	83	82
M	110	Venezuela	22	28	2.5	1.7	3,020	7,900	88	55

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Sub Saharan Africa

			1	2	3	4	5	6	7	8
			Total Population		Population Growth		GNP per Capita		Access to Safe Water	Access to Sanitation
			millions		average annual growth rate (%)		$	PPP*	% of population	% of population
			1995	2010	1980-95	1995-2010	1995	1995	1989-95	1989-95
L	111	Angola	11	16	2.9	2.8	410	1,310	32	16
L	112	Benin	5	8	3.1	2.6	370	1,760	70	22
M	113	Botswana	1	2	3.2	1.7	3,020	5,580	70	55
L	114	Burkina Faso	10	15	2.7	2.6	230	780	..	14
L	115	Burundi	6	9	2.8	2.5	160	630	58	48
L	116	Cameroon	13	20	2.8	2.9	650	2,110	41	40
L	117	Central African Re	3	4	2.3	2.0	340	1,070	..	..
L	118	Chad	6	9	2.4	2.4	180	700	29	32
L	119	Congo Dem Rep	44	..	3.2	..	120	490	25	9
L	120	Congo, Rep	3	4	3.0	2.6	680	2,050	60	9
L	121	Cote d'Ivoire	14	19	3.6	2.2	680	1,580	82	54
L	122	Eritrea	..	..	..	..	1	..	..	..
L	123	Ethiopia	56	86	2.7	2.8	100	450	27	10
M	124	Gabon	1	22	3.0	2.3	3,490	..	67	76
L	125	Gambia, The	1	22	3.7	2.1	320	930	61	34
L	126	Ghana	17	25	3.1	2.4	390	1,990	56	42
L	127	Guinea	7	10	2.6	2.8	550	..	49	6
L	128	Guinea-Bissau	1	1	1.9	2.1	250	790	57	20
L	129	Kenya	27	37	3.2	2.2	280	1,380	49	43
M	130	Lesotho	2	3	2.5	2.1	770	1,780	57	35
L	131	Liberia	..	..	..	..	1	..	..	..
L	132	Madagascar	14	21	3.0	2.8	230	640	32	17
L	133	Malawi	10	14	3.1	2.4	170	750	54	64
L	134	Mali	10	15	2.6	3.0	250	550	44	44
L	135	Mauritania	2	3	2.6	2.3	460	1,540	72	64

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M	136	Mauritius	1	1	1.0	1.0	3,380	13,210	100	100
L	137	Mozambique	16	23	1.9	2.4	80	810	28	23
M	138	Namibia	2	2	2.7	2.3	2,000	4,150	57	36
L	139	Niger	9	15	3.3	3.2	220	750	57	15
L	140	Nigeria	111	164	3.0	2/6	260	1,220	43	38
L	141	Rwanda	6	11	1.4	3.5	180	540	..	..
L	142	Senegal	8	12	2.8	2.5	600	1,780	..	..
L	143	Sierra Leone	4	6	1.7	2.7	180	580	..	..
L	144	Somalia	..	..	..	..	l	..	..	..
M	145	South Africa	41	55	2.3	1.9	3,160	5,030	..	46
L	146	Sudan	27	37	2.4	2.2	l	..	77	55
L	147	Tanzania/b	30	44	4.1	2.6	120	640	69	86
L	148	Togo	4	6	3.0	2.7	310	1,130	67	20
L	149	Uganda	19	28	2.7	2.6	240	1,470	42	60
L	150	Zambia	9	12	3.0	2.1	400	930	47	42
L	151	Zimbabwe	11	14	3.0	1.6	540	2,030	74	58

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M middle income economy l estimated to be a low-income country m estimated to be middle incomecountry

Exploring the Data Table

1. Make a copy of the blank Comparative Data Table and label the first column Countries, the second column Access to safe water, 1989-95, the third Population growth rate, 1980-95, and the fourth GNP per capita, 1995. Then use the text and the Data Table to fill in the chart according to the instructions below.

   a. Choose a low-income country in Sub-Saharan Africa and one in Asia (South and East) and the Pacific, and write their names in the first column.

   b. Choose a middle-income country in Europe and Central Asia, one in Middle East and North Africa, and one in South America, and add them to the first column.

   c. Choose a high-income country in North and Central America and the Caribbean, one in Europe and Central Asia, and one in Asia (South and East) and the Pacific, and add them to the first column.

   d. Label each country in your data table with an L, M, or H to show which income group it belongs to: low, middle, or high.

   e. Read the definitions of access to safe water, population growth rate, and GNP per capita. Go to the Data Table, and for each of your countries, find the percentage of population with access to safe water (1989–95), average annual population growth rate (1980–95), and GNP per capita (1995), and write this information in the appropriate columns of your data table. If data for one of the indicators are not available, select another country from the same income group and region.

   f. Rank the countries, with "1" equaling the highest access to safe water and "8" the lowest. Write the appropriate ranking number in parentheses after the data in column 2.

   g. Study your chart and answer the following questions:

   - In the countries with less than 50 percent access to safe water, are the other indicators high or low? **[Answers will vary.]**
   - In the countries with 50 to 69 percent access to safe water, are the other indicators higher or lower than in the below 50 percent access countries? **[Answers will vary.]**
   - In the countries with 70 or more percent access to safe water, are the other indicators higher or lower than in the other countries? **[Answers will vary.]**

   h. Does access to safe water follow the same trends as the other development

indicators in your chart? **[Answers will vary.]**

2. Make a copy of the blank Comparative Data Table and label the first column Countries, the second column Access to safe water, 1989-95, and the third column Access to sanitation, 1989-95. Compare access to safe water and access to sanitation in six countries from six different regions of the world by following these steps:

   a. In the column at the left of the table, write the following countries and their regions: Brazil (South America); Ghana (Sub-Saharan Africa); Philippines (Asia, South and East, and the Pacific); Jordan (Middle East and North Africa); Canada (North and Central America and the Caribbean); Ukraine (Europe and Central Asia).

   b. Use the Data Table to find the percentage of the population with access to safe water for each country and fill in column 2 in your table.

   c. Use the Data Table to find the percentage of the population with access to sanitation for each country and fill in column 3 in your table.

   d. Compare the access to safe water and access to sanitation data for each country. Within each country, which indicator is higher, access to safe water or to sanitation? **[In all of these countries more people have access to safe water than to sanitation.]** Are there any countries that have a large difference between the two? **[Yes. In the Ukraine, almost 50 percent more people have access to safe water than to sanitation. In Jordan, more than 50 percent more people have access to safe water than to sanitation.]** What are some possible reasons for this? **[Possible answer: Sanitation, although crucial for public health, tends to be considered a less immediate need than safe water. Countries must prioritize as they develop the basic systems and structures that allow their economies to function, and when made to chose, they tend to place safe water ahead of sanitation.]**

3. Take the Comparative Data Table you prepared for question 2 above, and add a fifth column labeled Access to sanitation, 1989-95.

   a. Use the Data Table to find the percentage of population with access to sanitation for each of your countries and fill in column 5 in your table. Within each country, which indicator is higher, access to safe water or to sanitation? **[Answers will vary.]** Compare your results with those in question 2d. Do your countries follow similar trends? If not, what could be some possible reasons for the differences? **[Answers will vary.]**

   b. Judging from your data, which indicator tends to be more linked to country

income group, access to safe water or access to sanitation? **[Answers will vary.]**

c. Make a general statement about access to safe water and sanitation and development. **[Answers will vary. Possible answers: Safe water and sanitation are both contributors to development and results of development. Safe water and sanitation are so important for children's health that they can be factors in people's willingness to have fewer children and thus can help decrease the population growth rate. They are important for economic growth because (at minimum) they help to keep workers healthy and productive. In addition, access to safe water and sanitation tends to increase as countries have more money to spend on piped water and waste collection and treatment systems.]**

Water Treatment Plant, Colombia

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Exploring Photo 1 - Water Treatment Plant, Colombia

1. Look at the photograph. Describe what you see. **[A woman is holding a beaker of clean water at a water treatment plant.]**

2. Would this be a common scene in your country? Why or why not? **[Answers will vary.]**

3. In which country was this photograph taken? **[Colombia]**

4. Find the country in the world and regional map gallery. What region is it in? **[South America]**

5. Find the country in the Data Table and determine if it is a low-, middle-, or high-income economy. **[It is a middle-income economy.]**

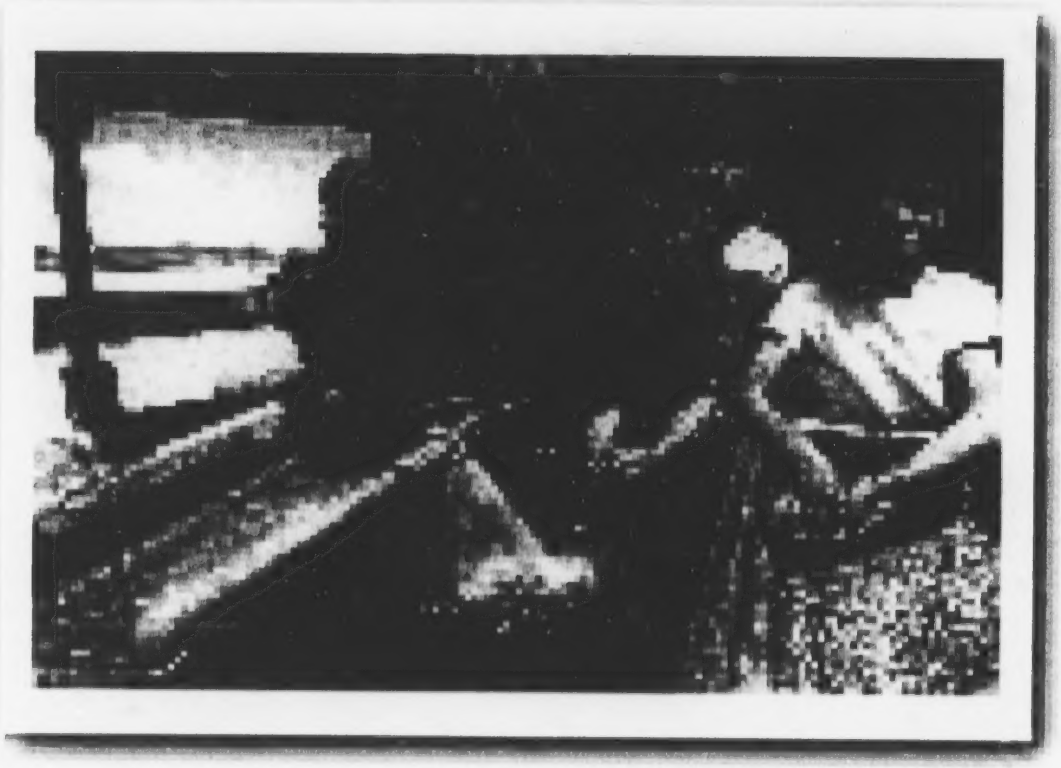
6. According to the Data Table, what is this country's projected population growth rate for 1995-2010? **[1.3%]** Its 1995 GNP per capita? **[$1,910]** The percentage of its 1989-1995 population with access to safe water? **[96%]**

7. What do you think life is like for the average person in this country? Support your answer. **[Answers will vary, but should take into account the possible effects of the population growth rate, the GNP per capita, and the percentage of the population with access to safe water on the quality of life.]**

8. What, if any, aspects of the activity shown in the photograph might help improve living standards in industrial countries? In developing countries? **[Possible answer: In both industrial and developing countries, treating wastewater can reduce environmental pollution and improve the quality of water used for drinking and recreation. Improvements in the water supply can ensure a more healthy population, thus increasing the productivity of the workers and improving the overall quality of life.]**

9. Which sector of development (i.e., social, economic or environmental) is best represented by the photograph? **[Environmental]** Explain your answer. Is it possible for this photograph to represent other sectors as well? In what way? **[Answers will vary.]**

10. In what ways might the activity in the photograph encourage sustainable development? In what ways might it discourage sustainable development? Explain your answer. **[Possible answer: By removing pollutants from water before returning it to the environment, people make sure that their use of water now does not compromise their ability to use it later. Also, treating wastewater ensures that the environment does not become damaged by the pollutants present in the human, industrial and agricultural waste in sewage.]**



Children Washing Hands, Guatemala

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Exploring Photo 2 - Children Washing Hands, Guatemala

1. Look at the photograph. Describe what you see. **[Children are washing their hands and playing with water at an outdoor spigot.]**

2. Would this be a common scene in your country? Why or why not? **[Answers will vary.]**

3. In which country was this photograph taken? **[Guatemala]**

4. Find the country in the world and regional map gallery. What region is it in? **[North and Central America and the Caribbean]**

5. Find the country in the Data Table and determine if it is a low-, middle-, or high-income economy. **[It is a middle-income economy.]**

6. According to the Data Table, what is this country's projected population growth rate for 1995-2010? **[2.5%]** its 1995 GNP per capita? **[$1,340]** The percentage of its 1989-1995 population with access to safe water? **[64%]**

7. What do you think life is like for the average person in this country? Support your answer. **[Answers will vary, but should take into account the possible effects of the population growth rate, the GNP per capita, and the percentage of the population with access to safe water on the quality of life.]**

8. What, if any, aspects of the activity shown in the photograph might help improve living standards in industrial countries? In developing countries? **[Possible answer: In both industrial and developing countries, frequent handwashing can help prevent disease. People are more likely to wash their hands if they have easy access to safe water and are educated in the benefits of good hygiene.]**

9. Which sector of development (i.e., social, economic or environmental) is best represented by the photograph? **[Environmental]** Explain your answer. Is it possible for this photograph to represent other sectors as well? In what way? **[Answers will vary.]**

10. In what ways might the activity in the photograph encourage sustainable development? In what ways might it discourage sustainable development? Explain your answer. **[Possible answer: Studies have suggested that improved access to safe water and sanitation can cause dramatic improvements in health and life expectancy. When people are healthier, they tend to be more productive and hence are better able to contribute to sustainable development. In addition, when children are healthier, infant mortality decreases and parents tend to be**

content with having fewer children. The resulting slowing of population growth rates can lessen the stress on social, financial, and natural resources. The activity in the photograph may discourage sustainable development if the children pictured are wasting the water, or if there is no wastewater treatment process in place. In the long run, overusing water resources or neglecting to clean wastewater can seriously compromise the environment's ability to provide enough safe water for the future.]

Case Study 1- The Water Problem in My Village, Bolivia

I'm not good at talking in front of a group of people. I'm a farmer and spend my days in the fields. The work is often solitary, but I like it. So when Father Rodriguez asked me to speak to the congregation in a neighboring village and answer questions, I was very nervous. What if I gave the wrong answer? Or stuttered? Or said something stupid and people laughed?

He wanted me to talk about the water problem in my village. Where my wife and I live with our baby son it is high and arid like it is here; we don't have electricity either, and we share some of the same health problems, like diarrhea, scabies, and respiratory infections. But unlike my village, this one doesn't have covered wells and hand pumps. And before last year, we didn't have them either.

I heard the priest call my name. I dried my palms on my pants, and with my head down, watching my feet so they wouldn't trip over themselves, I moved to the front of the church. When I lifted my head, sixty strangers were staring at me. My knees started to shake and I almost sat down again-until I remembered Juanita.

"My name is Miguel Sanchez," I whispered. My own voice sounded strange in my ears. I cleared my throat. "I've come from the neighboring village over the mountain to talk to you about water," I began. The congregation turned to each other in confusion. I could see the question marks stamped on their faces. Water? They seemed to be asking each other. Holy water? I started over.

"Two years ago my first child, Juanita, was born. She was a beautiful baby who looked just like her mother. She was chubby and happy with dark shining eyes. I used to love to put her on my shoulders and listen to her laugh. But after my daughter was weaned she started to get sick. She frequently had diarrhea and stopped gaining weight. The last time Juanita was sick, my wife made sure that she had plenty of well water to drink so that she would not become dehydrated. But it didn't seem to make her better and then, only a week later, she died.

"My wife and I were heartbroken, but we weren't the only ones who had lost loved ones. Other children in our village, and some older people with the same sickness, had died.

"Soon after Juanita died, the school teacher in our village heard about a new water system in a nearby town, and invited the people who helped them build it to come visit us. Some engineers and health care workers came to our village and tested our well water and river water and found that both sources were polluted with bacteria. Because the water was contaminated and we hadn't boiled it, the water we had been giving our daughter had been making her diarrhea worse. We thought we were helping her, but we had just made her sicker. In fact, the water was harming the whole village.

"The families came together and decided to work with the water project people to improve the water supply. The health care worker told us the bacteria comes from animal and human waste on the ground that washes into the well and the river when the rains come. The bacteria infects the

water and makes it dangerous to drink and to wash with. The engineers explained how to build stronger well walls out of sand and mortar and how to build covers to protect the well water. They also studied the way the water drained after it rained to help us pick the best spot to dig the new well.

"At least one person from each family—men and women—had a job to do on the water committee, some ordering parts, others digging the well, others learning how to repair the pump. The engineers trained each of us in different areas and taught us how to manage the well on our own. I'm not good with numbers, but a storekeeper who is figured out how much each household would pay for the water. I am good at working with my hands—I was in charge of laying the stone foundation for our chapel—so they trained me to do the masonry work. With help from the other men, we dug a new hole for the well, poured the cement and lime mixture, covered the well, and installed the hand pump. The school teacher taught the villagers how to become healthier by washing our hands and fruits and vegetables with clean water before eating and how to store clean water safely so that it doesn't become contaminated. He also taught us to boil our water before drinking it to be sure it is safe.

"Now all of us in the village take turns being in charge of maintaining the well and hand pump and replacing parts so it doesn't break down. We don't get paid with money, but we all benefit from having safe water. Occasionally the hand pump breaks, and then we must wait for a part. But together we take responsibility for the well, and we don't have to rely on outside help to keep it going. The longest we have gone without clean water in the last year has been just three days while we were waiting for a part. Even though my wife still has to carry the water from the well to our house, most days we not only have enough safe water to drink, but also enough to wash more often—and fewer people have been sick.

"It's too late for our daughter Juanita, but now my wife and I feel that we have more to offer our son, and we are expecting another child in the spring. Father Rodriguez asked me to talk to you so that you would know what I had lost and now what my whole village has gained. Like the people of my village, you can work together to have better water and healthier lives."

Exploring Access to Safe Water Case Study 1

1. What are some of the health problems shared by Miguel's village and the one he is visiting? **[In both villages, people suffer from diarrhea, scabies, and respiratory infections.]** Which of these problems might be related to the lack of safe water? **[All are water related to some degree, but especially diarrhea.]**

2. How is it that people die of diarrhea? **[They become dehydrated.]**

3. In Miguel's village, how did the sources of water become contaminated? [Human and animal waste washed from the ground into the sources of water.] How did this contamination affect Miguel's family? **[His daughter died from diarrhea caused by the polluted water.]**

4. How do higher well walls and covers help to protect the water? [They keep pollutants from washing into the water.]

5. What training did the villagers receive as part of their water project? [They learned how to dig and build the wells so that the water would not become contaminated; how to install, operate, maintain, and repair hand pumps; how to store water so that it does not become contaminated; how to use safe water for hygiene and food preparation to avoid ingesting bacteria.]

6. Why didn't the people from the water project dig the wells and install the handpumps themselves?
[If the project people had done all of the work, the people in the village would not have learned how to do the work themselves and would have had to rely on outside help if the equipment broke down or if they decided they wanted to dig another well. This way the villagers have control over their access to water.]

7. Find Bolivia in the Data Table. What is the 1989-95 percentage of the population with access to safe water? [60%]What is the 1980-95 population growth rate? [2.2%] What is the 1995 GNP per capita? [$800] If more projects like the one in Miguel's village were to increase the percentage of people with access to safe water, what changes might you expect to see in these and other indicators? Explain you answer. [Possible answer: Over time, there might be a drop in the population growth rate, since people would not have to have as many children in the hope that a few would survive. People would probably be healthier and more productive, possibly bringing about an increase in GNP per capita. Infant mortality would probably decrease and life expectancy would probably increase.]

8. Go to the Data Table and find out how the 1989-95 percentage of the population with access to safe water in Bolivia compares with that of your country. [Answers will vary.] Would a project like
the one outlined in the case study work in your community? Explain your answer.

9. Are you aware of any community-run utilities (water, electric, or gas providers) where you live?
What might be some advantages of such programs? What might be some disadvantages? [Answers
will vary.]

10. How does your community help ensure that the water you drink is safe? [Answers will vary.]

11. What kind of water supply problems, if any, might your community face? [Answers will vary.]

[Without answers] | [Back to Case Study 1] | [Top] | [Table of Contents]

Access to Safe Water Research and Explore

1. You are the prime minister of a low-income country with a population of 22 million. Sixty percent
of the population lives in rural areas; most of the rest live in the capital city. Experts say that in 10 years more than half the population will live in the cities.

Your country faces many problems. One of the most serious is that 17 million people lack adequate
sanitation and 15 million of these also lack access to safe water. As a result, thousands of people, mostly children, die each year. Listed below are some activities that may help improve access to safe
water and sanitation in your country. Because funds are limited, not all plans can be implemented at
once.

a. Choose the five activities that you would undertake first and rank them in the order in which you would implement them. Explain why you chose this ranking.
   Set up a team of experts to monitor the quality of the drinking water in wells, lakes, and rivers in rural areas throughout the country.
   Establish a Water Supply Board that will charge households, farmers, and industries the full cost of the water they use and will collect these fees.
   Expand the system of water pipes in urban areas so that even the poorest people have a faucet within 500 feet of their homes.
   Set up a team of experts to monitor the quality of the drinking water in urban areas throughout the country.
   Give tax breaks to those who dig their own wells to supply their own water.
   Run a media campaign using billboards, posters, radio, television, and newspapers to

teach people the importance of hand washing and hygiene, how to make their drinking water safer, and how best to care for people, especially children, if they get sick from unsafe water.

Give the poorest people special vouchers that can be used as money to buy safe water or fuel for boiling the water they have.

Repair existing water and sewer pipes in urban areas so that clean water is not wasted and dirty water can be safely carried away.

Make laws that force factories to stop dumping their untreated waste water into rivers and lakes, and establish a team of inspectors to enforce the laws.

Build two large additional sewerage treatment plants for the capital city.

Create five mobile health teams that will travel around the country teaching people about the importance of hand washing and better hygiene, how to make their drinking water safer, and how to care for people, especially children, who get sick from dirty water.

b. Are there any activities listed that you would not use? Explain.

c. What are three additional activities that you would add to your list? Describe each one and explain how would you fit them into your ranking.

2. How does your family use water and how much do they use?

a. Make a table with 3 columns. In the first column, list all of the ways water is consumed by your family over the course of a week. In the second column, write how frequently each activity is performed (for example, drinking: 210 glasses/week; laundry: 5 loads/week.) In the third column, figure out the approximate amount of water consumed by this activity each week. If you do not know how much water is used for a given activity, you can use the following list* to make estimates. For activities that are not listed, for example washing a car with a hose, you can approximate consumption by timing how long it takes to wash the car, and multiply that by the amount of water flows through the hose per minute.

Toilet flush
6-11 litres
Bath
120 litres
Shower
14 litres/minute
Washing machine
150 litres/load
Dishwashing (auto)
30 litres/load
Dishwashing (by hand)
10 litres
Sprinkler
10 litres/minute
Running garden hose
20 litres/minute
Running tap water

6-10 litres/minute
Filling swimming pool
50,000 litres/pool

b. How much water is wasted by water system leaks in your home? Check for leaking faucets, running toilets, and leaking water tanks. A slow drip from a water tap can waste up to 11,000 litres/month; even more for a steadily running toilet.
c. Make a list of at least ten ways you can help to conserve water in your household, then choose three of the most promising and try to do them for one month in your home. At the end of the month figure out how much water you have saved.
d. If your family receives a monthly phone bill, compare the water bill from the month before you started your conservation efforts with the next month's bill. How much money did you save your family?

* This list is based on information from the Yarra Valley Water website developed by Yarra Valley Water, Victoria, Australia. For additional water system activities, see their web site at www.yvw.com.au/schools/index.htm.

3. In order to make responsible decisions about community water supplies, it is important to have a full understanding of where water comes from and how water quality is maintained. Research your own water supply by answering the following questions. Use a variety of sources which may include your family, government offices, library, newspapers, internet, and local utility companies.

a. Where does your water come from, and how does it get to your home?
b. Does everyone in your community get their water from the same source? If not, what are the other sources, and how many people use them?
c. Are some of these sources more expensive than others?
d. How is water from all of the sources tested for quality, and how frequently? Are some of the sources safer than others?
e. What are the greatest threats to water quality where you live?
f. How reliable is your water supply? Research the average rainfall for your area. When are the driest months? Are there times when safe water is in short supply? If yes, what does your community do at these times?
g. What can you do to help ensure sustainable water use in your community?

Research and Explore

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g. What can you do to help ensure sustainable water use in your community?

World Bank

Glossary

Access to safe water.

Measured by the number of people who have a reasonable means of getting and adequate amount of clean water, expressed as a percentage of the total population. It reflects the health of a country's people and the country's ability to collect, clean, and distribute water. In urban areas "reasonable" access means there is a public fountain or water spigot located within 200 meters of the household. In rural areas, it implies that members of the household do not have to spend excessive time each day fetching water. Water is safe or unsafe depending on the amount of bacteria in it. An adequate amount of water is enough to satisfy metabolic, hygienic, and domestic requirements, usually about 20 liters (about 4 gallons) per person per day.

Access to sanitation.

Refers to the share of the population with at least adequate excreta disposal facilities that can effectively prevent human, animal, and insect contact with excreta. Suitable facilities range from simple but protected pit latrines to flush toilets with sewerage. To be effective, all facilities must be correctly constructed and maintained.

Adult illiteracy rate.

The proportion of the population over age fifteen who cannot, with understanding, read and write a simple statement about their everyday life and do simple mathematical calculations.

Bilharzia.

A life-threatening parasitic disease caused by a worm that lives in a host snail. Humans can become infected when they come in contact with water in ponds and rivers where the snail lives. Occurs most often in tropical regions. Also called schistosomiasis.

Billion.

One billion equals 1,000,000,000 or one thousand million.

Biodiversity.
The variability among living organisms from all sources, including land based and aquatic ecosystems, and the ecosystems of which they are part. These include diversity within species, between species, and of ecosystems. Diversity is the key to ensuring the continuance of life on Earth. It is also a fundamental requirement for adaptation and survival and continued evolution of species.

Birth rate.
The number of births in a year per 1,000 population.

Capital.
The money or wealth needed to produce goods and services. See also human capital and physical capital.

Carrying capacity. The population that an area will support without undergoing environmental deterioration.

Cholera.
Any of several diseases of man and domestic animals usually marked by severe gastrointestinal symptoms.

Commodity.
See primary goods or products.

Death rate.
The number of deaths in a year per 1,000 population.

Deforestation.
The process of clearing of forests. Since trees root systems are essential for keeping top soil in place, deforestation can bring about soil erosion. In addition, loss of trees is said to contribute to global warming because trees reduce greenhouse gases and provide shade.

Demography.
The statistical study of human populations, especially with reference to size and density, distribution and vital statistics.

Desertification.
The process of becoming desert (as from land management or climate change).

Developing country.
Low- and middle-income countries in which most people have a lower standard of living with access to fewer goods and services than do most people in high-income countries. There are currently about 125 developing countries with populations over 1 million; in 1995, their total population was more than 4.7 billion.

Diarrheal illness.
A disease that affects the intestines. The victims of this disease, frequently children in low- and middle-income countries, may die from the resulting dehydration.

Economic growth/development.
The process by which a country increases its ability to produce goods and services.

Ecosystem.
A community of plants and animals existing in an environment that supplies them with water, air, and other elements they need for life.

Ecosystem integrity.
The extent to which the interrelationships among and within ecosystems remain intact so that the number and variety of living organisms can be maintained.

Elephantiasis.
A disease, often found in tropical countries, in which parts of the human body become enlarged. It is caused by small roundworms that are injected into the body by mosquitoes.

Environment.
The complex set of physical, geographic, biological, social, cultural and political conditions that surround an individual or organism and that ultimately determines its form and nature of its survival.

Export.
To sell goods or services to a buyer outside your country.

Factors of production.
Input used to produce goods and services, for example, capital or labor.

Family planning.
A health service that helps couples decide whether to have children, and if so, when and how many.

Fertility rate (total).
The average number of children a woman will have during her lifetime. The total fertility rate in developing countries is between three and four; in industrial countries it is less than two.

Goods and services.
Things that are produced by a country's economy. Examples of goods include food, clothing, machines, and new roads. Examples of services include those of doctors, teachers, merchants, tourist agents, construction workers, and government officials.

GNP (gross national product).
The value (in U.S. dollars) of a country's final output of goods and services in a year. The

value of GNP can be calculated by adding up the amount of money spent on a country's final output of goods and services, or by totaling the income of all citizens of a country including the income from factors of production used abroad.

GNP per capita.
The dollar value of a country's final output of goods and services in a year (its GNP), divided by its population. It reflects the average income of a country's citizens. Knowing a country's GNP per capita is a good first step toward understanding the country's economic strengths and needs.

GNP per capita growth rate.
The change in GNP per capita over a period, expressed as a percentage of GNP per capita at the start of the period.

Growth rate.
The change (increase, decrease, or no change) in an indicator over a period of time, expressed as a percentage of the indicator at the start of the period. Growth rates contain several sets of information. The first is whether there is any change at all; the second is what direction the change is going in (increasing or decreasing); and the third is how rapidly that change is occurring. For example, if a country's GNP growth rate for a particular year is more or less than zero, there has been a change in the amount of goods and services produced in that year. If the GNP growth rate is positive, the country is producing more goods and services at the end of the year than at the beginning. If the GNP growth rate is negative, the country is producing fewer goods and services than at the beginning of the year. Note that a change in GNP growth rate from 2% one year to 1% the next year does not mean that the total production of goods and services has decreased. As long as the growth rate is positive, the GNP is growing. The only time the production of goods and services has actually decreased is when the GNP growth rate is negative.

High-income country.
A country having an annual gross national product (GNP) per capita equivalent to $9,386 or greater in 1995. Most high-income countries have an industrial economy. There are currently about 26 high-income countries in the world with populations of one million people or more. Their combined population is about 0.9 billion, less than one-sixth of the world's population.

Hookworm.
An intestinal parasite found in tropical and subtropical regions. It passes through the skin, especially bare feet, and is spread by unsanitary conditions.

Human capital.
People and their ability to be economically productive. Education, training, and health care can help increase human capital. See also capital and physical capital.

Hygiene.
Practices, such as frequent hand washing, that help ensure cleanliness and good health.

Import.
To buy goods and services from another country.

Indicator.
A numerical measure of quality of life in a country. Indicators are used to illustrate progress of a country in meeting a range of economic, social, and environmental goals. Since indicators represent data that have been collected by a variety of agencies using different collection methods, there may be inconsistencies among them.

Industrial country.
A country in which historically the greatest part of output has been accounted for by industry. However, the term is widely used to signify high-income economies.

Industrial waste.
Material—for example, certain chemicals or even very hot water—left over from a manufacturing process. It can be harmful sometimes and may pollute the water and the environment if not treated and/or disposed of properly.

Infant mortality rate.
The number of infants, out of every 1,000 babies born in a given year, who die before reaching age 1. The lower the rate, the fewer the infant deaths, and generally the greater the level of health care available in a country.

Informal economy.
The exchange of goods and services not accurately recorded in government figures and accounting. The informal economy, which is generally untaxed, commonly includes goods and services including day care, tutoring, or black market exchanges.

Investment.
Money spent now in order to make the economy grow and have more money—or goods and services—later.

Life expectancy at birth.
The average number of years newborn babies can be expected to live based on current health conditions. This indicator reflects environmental conditions in a country, the health of its people, the quality of care they receive when they are sick, and their living conditions.

Literacy.
The ability to read and write a simple statement about one's everyday life and do simple mathematical calculations.

Low-income country.
A country having an annual gross national product (GNP) per capita equivalent to $765 or less in 1995. The standard of living is lower in these countries; there are few goods and services; and many people cannot meet their basic needs. There are currently about 58

low-income countries with populations of 1 million or more. Their combined population is almost 3.2 billion.

Manufactured products.
Goods--for example, shoes, trucks, paper, radios, electric motors, and canned fruit-that are produced from raw materials by hand or by machine.

Middle-income country.
A country having an annual gross national product (GNP) per capita equivalent to more than $765 but less than $9,386 in 1995. The standard of living is higher than in low-income countries, and people have access to more goods and services, but many people still cannot meet their basic needs. There are currently about 67 middle-income countries with populations of one million or more. Their combined population is more than 1.5 billion.

Natural resource accounting.
The process of adjusting national accounts such as GNP to reflect the environmental costs of economic production. Although methods are still being developed, natural resource accounting strives to determine the costs of depleting natural resources and damaging the environment.

Natural resources.
Materials that occur in nature and are essential or useful to humans, such as water, air, land, forests, fish and wildlife, topsoil, and minerals.

Physical capital.
Things, such as machinery, tools, equipment, furniture, parts, and buildings, that are needed to produce goods and services. See also capital and human capital.

Population growth rate (average annual).
The increase in a country's population during one year, divided by the population at the start of that year. It reflects the number of births and deaths during the period and the number of people moving to and from a country. The average annual population growth rates for a period of years provide a better picture than do rates for a single year. In 1995 total world population was more that 5.6 billion, and the average world population growth rate was between 1980 and 1995 1.6.

Population momentum.
The tendency for population growth to continue beyond the time that replacement-level fertility has been achieved because of a relatively high concentration of people in the childbearing years. For example, the absolute numbers of people in developing countries will continue to increase over the next several decades even as the rates of population growth will decline. This phenomenon is due to past high fertility rates which results in a large number of young people. As these youth grow older and move through reproductive ages, the greater number of births will exceed the number of deaths in the older populations.

Population projections.

Demographers make predictions about future population based on trends in fertility, mortality, and migration.

Prevalence of malnutrition under age 5.

The percentage of children under five years of age whose health and growth are jeopardized by lack of proper food.

Primary goods or products.

Goods--for example, iron ore, diamonds, wheat, copper, oil, or coffee-that are used or sold as they are found in nature. They are also called commodities.

Primary health care.

Health services, including family planning, clean water supply, sanitation, immunization, and nutrition education, that are designed to be affordable for both the poor people who receive the services and the governments that provide them; the emphasis is on preventing disease as well as curing it.

Purchasing power parity (PPP).

A method of measuring the relative purchasing power of different countries' currencies over the same types of goods and services. Because goods and services may cost more in one country than in another, PPP allows us to make more accurate comparisons of standards of living across countries. PPP estimates use price comparisons of comparable items but since not all items can be matched exactly across countries and time, the estimates are not always "robust."

Renewable.

Able to be replaced or replenished, either by the earth's natural processes or by human action. Air, water, and forests are often considered to be example of renewable resources. However, due to local geographic conditions and costs involved, strong arguments can be made that water may not be a completely renewable resource in some parts of the world, especially in developing countries or in areas with limited groundwater supplies. Minerals and fossil fuels are examples of non-renewable resources.

Replacement level.

The fertility level at which couples have the number of children required to replace themselves, this is about two children. When the replacement level is reached, population growth will stabilize in time. (See definitions for Population Momentum and Transition.)

Resources.

The machines, workers, money, land, raw materials, and other things that a country can use to produce goods and services and to make its economy grow. Resources may be renewable or nonrenewable. Countries must use their resources wisely to ensure long term prosperity.

Sanitation.
Maintaining clean, hygienic conditions that help prevent disease through services such as garbage collection and wastewater disposal.

Sanitation facilities.
Basic sewerage and drainage systems that collect waste water and then clean and redistribute it.

Sewage.
Refuse liquids or waste matter carried off by sewers.

Sewerage.
A system of sewers or drainage pipes.

Silting.
The process whereby waterways become choked by mud and soil that has washed off the land through erosion.

Social services.
Services generally provided by the government that help improve people's standard of living; examples are public hospitals and clinics, good roads, clean water supply, garbage collection, electricity, and telecommunications.

Sources of water.
House connection/yard tap: Piped water from the public water distribution system that reaches the home or yard. When people have house connections, they usually have indoor plumbing as well; if they have yard taps, they have to go outside to get water. Shallow well: A well dug on public or private property for public consumption. Public wells usually provide water for little or no cost; water from private wells is usually more expensive. Shallow wells are not always reliable sources of water because they can become contaminated by run off in the rainy season or dry up in the dry season. Yard well: A shallow well in a yard usually intended for private use. Standpost: An outside tap to which a number of households can go to get water. Public standposts are connected to the public water distribution system and controlled by the water company. Private standposts are not connected to the public water distribution system nor controlled by the water company. Private borehole and electric pump: A very deep well drilled into the ground using specialized machinery. Boreholes are used when the water is far below the surface or when the ground is too hard to dig a well by conventional means. Because they are so deep, they require an electric pump to bring water to the surface.

Sustainable development.
Development that meets the needs of the people today without compromising the ability of future generations to meet their own needs.

Total fertility rate.
See fertility rate (total).>

Transition.
Refers to the demographic change that is occurring in developing countries as they move to lower rates of fertility and mortality. Many factors contribute to transition including: improved health services, greater access to education and improved social and economic conditions. Several developing countries in Asia are now in the later stages of transition, while many countries in Sub-Saharan Africa are in the early stages of transition. Demographic transition is complete when fertility has reached replacement level, which is the case in most industrial countries.

Urbanization.
The process by which a country's population changes from primarily rural to urban. It is caused by the migration of people from the countryside to the city in search of better jobs and living conditions.

Wastewater.
Water that has been used and is no longer clean.

Wastewater treatment.
The process of removing pollutants from water that has been used. There are different stages of treatment. Primary sewage treatment involves screening the water to remove the largest solids from wastewater and then letting the water sit in settling tanks so that the smaller solids and particles sink to the bottom. Secondary treatment involves another stage in which microbes added to the wastewater to eat the biological pollutants, or the wastewater is put through another filter. Then the treated water is disinfected and released back into nature. The more steps included in the treatment, the more expensive the process.

Watershed.
The specific land area that drains water into a river system or other body of water.